Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854
Attn: Aaron Fox

May 7, 2019

Dear Mr. Fox,

Enclosed please find the toxicological evaluation and chemical analyses report for the effluent sample received on April 8th, 2019. This is your second quarter 2019 bioassay. Please call me at (401) 353-3420 if you have any questions.

Sincerely,

Michael McCallum
Technical Laboratory Director

NEW ENGLAND TESTING LABORATORY, INC.
59 Greenhill St., West Warwick, RI 02893
(401) 353-3420

TOXICOLOGICAL EVALUATION AND CHEMICAL ANALYSES OF EFFLUENT: NPDES Permit # MA0100633 Second Quarter 2019 Sample Lowell

Prepared For:
Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854

May 7, 2019

By
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, Rhode Island 02893

NETLAB CASE NUMBER: 9D08025

New England Bioassay
A Division of GZA

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

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Manchester, CT 06042
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NEW ENGLAND BIOASSAY A DIVISION OF GZA
CHRONIC AQUATIC TOXICITY TEST REPORT

Permitee: Lowell RWWU NPDES # MA0100633
Report submitted to: New England Testing Laboratories
59 Greenhill Street, West Warwick RI
Sample ID: Effluent
Test Month/Year: April 2019
NEB Proj # 05.0044476.00

Test Type / Method: *Ceriodaphnia dubia* Modified Chronic Static-Renewal Freshwater Test Method 1002.0; EPA 821-R-02-013

Effluent Sample Dates: #1 4/7-8/19 #2 4/9-10/19 #3 4/11-12/19

Test Start Date: 4/9/19

Results Summary

Your results were as follows:

Passed all permit limits

Acute Test Results

Species	LC50	A-NOEC	Permit Limit	Pass / Fail
Ceriodaphnia dubia	>100%	100%	≥ 100%	Pass

Chronic Test Results

Species	C-NOEC	C-LOEC	IC25	Permit Limit	Pass/Fail
Ceriodaphnia dubia	100%	>100%	>100%	N/A	N/A

Data Qualifiers affecting this test:

Certifications & Approvals: NH ELAP (2071), NJ DEP (CT405)

Test Report Certification

Permittee name:	Lowell RWWU	Permit number:	MA0100633
Client sample ID:	Effluent	Test Start Date:	4/9/19

Whole Effluent Toxicity Test Report Certification (Permittee)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: _____ (Date)

_____ Authorized Signature

_____ Print or Type Name and Title

_____ Print or Type the Permittee's Name

MA0100633 Print or Type the NPDES Permit Number

Whole Effluent Toxicity Test Report Certification (Bioassay Laboratory)

The results reported relate only to the samples submitted as received

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: 5/6/19 (Date)

Kimberly Wills
Laboratory Manager
New England Bioassay a division of GZA

General Test Conditions

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Start Date: 4/9/19

Sample Collection Information

Effluent #1 Dates/Times: 4/7-8/19 @ 0700-0700 Receiving Water #1 Date/Time: 4/8/19 @ 0830

Effluent #2 Dates/Times: 4/9-10/19 @ 0700-0700 Receiving Water #2 Date/Time: 4/10/19 @ 0820

Effluent #3 Dates/Times: 4/11-12/19 @ 0700-0700 Receiving Water #3 Date/Time: 4/12/19 @ 0830

Were a minimum of three samples collected? Yes ☑ No ☐ *(see note below)

Were samples used within the first 36 hours of collection? Yes ☑ No ☐ * (see note below)

* sample collection note:

Test Conditions

Permittee's Receiving Water: Merrimack River

- Dilution water: Laboratory synthetic soft water (hardness 45 - 55 mg/L CaCO3)
- Control water: Receiving water collected at a point immediately upstream of or away from the discharge

Effluent concentrations tested: 0%, 6.25%, 12.5%, 25%, 50%, 100%

Was effluent salinity adjusted? No ☑ Yes ☐ with Instant Ocean sea salts to _____ ppt

Dechlorination procedures: Chlorine is measured using 4500 CL-G DPD Colorimetric Method

- Dechlorination was not required

TRC results and further information about aeration of samples can be found attached in "sample receipt chemistry"

Reference Toxicant Data

Ceriodaphnia dubia

Date: 4/1/19

Toxicant: Sodium chloride

Dilution Water: NEB CTRMH

Organism Source: NEB

Reproduction IC25: 0.81 g/L

Results within range Yes ☑ No ☐

Ceriodaphnia dubia Test Results

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 4/9/19 - 4/15/19

Test Acceptability Criteria

Lab Diluent Survival:	100 %	Mean Lab Diluent Reproduction:	36.9 young per female
River Control Survival:	100 %	Mean River Control Reproduction:	37.3 young per female
Thiosulfate Control Survival:	N/A %	Mean Thiosulfate Control Reproduction:	N/A young per female

Presence of an asterisk (*) indicates EPA criteria was not met, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Results

		Permit Limit	Test Result	Pass/Fail Status
Acute Data	48 hr LC50	≥ 100%	>100%	Pass
	48 hr NOEC		100%	
	TUa			
Chronic Data	Chronic LC50		>100%	
	Survival C-NOEC		100%	
	Survival C-LOEC		>100%	
	Reproduction C-NOEC		100%	
	Reproduction C-LOEC		>100%	
	Reproduction IC25		>100%	
	Reproduction IC50		>100%	
	Reportable C-NOEC		100%	
	Reportable C-LOEC		>100%	
	MATC		>100%	
	TUc			

Presence of an asterisk (*) indicates qualified data, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Variability

Reproduction PMSD: 16.1% Upper & Lower EPA bounds: 13 - 47% ☐ Low ☑ Within bounds ☐ High

☐ PMSD exceeds upper bounds. Test results are highly variable and may not be sensitive enough to determine the presence of toxicity at the permit limit concentration (PLC)

☑ The PMSD falls within the upper (47%) and lower (13%) bounds. Results are reportable.

☐ PMSD falls below the lower bound test variability criterion. The test is very sensitive. The relative percent difference (RPD) between the control and each treatment was calculated and compared to the lower bound.

- ☐ The RPD values for all concentrations fall below the lower bound. Any differences observed in this test are considered statistically insignificant.
- ☐ Some of the concentrations that were flagged as statistically significant have RPD values that fall below the lower bound. Any differences observed in these concentrations will not be considered statistically significantly decreased from the control.
- ☐ No statistically significant reductions were observed in this test.

Ceriodaphnia dubia Test Results

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 4/9/19 - 4/15/19

Concentration - Response Evaluation

Survival: #12 No significant effects at any test concentration with a flat concentration-response curve. Test concentrations performed very similarly to dilution control.

Reproduction: #12 No significant effects at any test concentration with a relatively flat concentration-response curve. Test concentrations performed both above and below (but similarly to) the dilution control.

The concentration - response relationship was reviewed and the following determination was made:

Survival	Reproduction	
X	X	Results are reliable and reportable
		Results are anomalous (see explanation below)
		Results are inconclusive - retest (see explanation below)

Results Discussion (if applicable):

TEST METHODS

Ceriodaphnia dubia

Test type:	Modified Chronic Static Renewal Freshwater Test
Test Reference Manual:	EPA-821-R-02-013 "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms"
Test Method:	*Ceriodaphnia dubia* Survival and Reproduction Test - EPA 1002.0
Temperature:	25 ˚C ± 1˚C (Temperatures should not deviate by more than 3˚C during the test) (required)
Light Quality:	Ambient Laboratory Illumination (recommended)
Light Intensity:	10-20 µE/m2/s, or 50-100 ft-c (recommended)
Photoperiod:	16 hours light, 8 hours dark (recommended)
Test chamber size:	30 mL (recommended minimum)
Test solution volume:	15 mL (recommended minimum)
Renewal of Test Solutions:	Daily (required)
Age of Test Organisms:	Less than 24 hours; and all released within a 8-h period (required)
Number of Neonates Per Test Chamber:	1 Assigned using blocking by known parentage (required)
Number of Replicate Test Chambers Per Treatment:	10 (required minimum)
Number of Neonates Per Test Concentration:	10 (required minimum)
Feeding Regime:	Fed 0.1 mL each of YCT and algal suspension per exposure chamber daily. (recommended)
Cleaning:	Use new plastic cups daily (recommended)
Aeration:	None (recommended)
Test Duration:	Until 60% or more of control females have three broods (maximum test duration 8 days) (required)
Endpoints:	Survival and reproduction (required)
Test Acceptability:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods. (required)
Sampling Requirements:	Minimum of three samples with a maximum holding time of 36 hours before first use. (required)
Sample volume required:	1 L/Day (recommended)

CERIODAPHNIA DUBIA
DATASHEETS & STATISTICAL ANALYSIS

NEW ENGLAND BIOASSAY TOXICITY DATA FORM
CHRONIC COVER SHEET

CLIENT:	New England Testing Laboratories	*C.dubia* TEST ID #	19-449
ADDRESS:	59 Greenhill Street	CHAIN OF CUSTODY #	C39-1787/88
	West Warwick, RI 02893	NEB PROJECT #	05.0044476.00
PERMITTEE:	Lowell RWWU	SAMPLE ID:	Effluent
PERMIT NUMBER:	MA0100633		
DILUTION WATER:	Laboratory Soft Water		

INVERTEBRATES

TEST SET-UP TECHNICIAN:	PD
TEST SPECIES:	*Ceriodaphnia dubia*
NEB LOT #	Cd19(RMH 066)
AGE:	< 24 hours
TEST SOLUTION VOLUME (mls):	15
ORGANISMS PER TEST CHAMBER:	1
ORGANISMS PER CONCENTRATION:	10

LABORATORY CONTROL WATER (SRCF)

Lot Number	Hardness mg/L $CaCO_3$	Alkalinity mg/L $CaCO_3$
C39-S008	50	35

	DATE	TIME
TEST START:	4/9/19	1141
TEST END:	4/15/19	0950

COMMENTS: _____

REVIEWED BY: _____ DATE: 5/6/19

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850		
NEB PROJECT NUMBER: 05.0044476.00	NEB TEST NUMBER: 19-449		COC # C39-1787/88
TEST ORGANISM: *Ceriodaphnia dubia*	AGE: <24 hours		Lot # Cd19(RMH 066)
START DATE: 4/9/19	TIME: 1141	END DATE: 4/15/19	TIME: 0950

Culture Lot# Cd19(RMH 066)

Effluent Concentration	Cup # / Day Number	B2	B3	B4	B5	B6	B8	B11	B12	B13	A12	Total Live Young	# Live Adults	Analyst-Transfer	Analyst-Counts
		Replicate													
		A	B	C	D	E	F	G	H	I	J				
NEB Lab Synthetic Diluent	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	PD	
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	KO	
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	MM	
	3	5	✓	7	6	6	✓	7	5	5	5	46	10	CW	CW
	4	12	3	13	9	14	6	11	11	15	15	109	10	PD	PD
	5	✓	✓	✓	3	✓	11	✓	✓	✓	✓	14	10	CW	CW
	6	20	19	23	16	23	17	20	20	23	19	200	10	CH	CH
	7														
	totals	37	22	43	34	43	34	38	36	43	39	369	10		MC
Merrimack River Control		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	6	6	6	6	7	✓	6	6	✓	4	47	10		
	4	12	14	14	15	12	6	15	14	7	14	123	10		
	5	✓	✓	✓	✓	✓	14	✓	✓	5	✓	19	10		
	6	19	18	24	24	24	19	17	11	8	20	184	10		
	7														
	totals	37	38	44	45	43	39	38	31	20	38	373	10		
6.25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	5	5	4	6	6	5	6	5	5	5	52	10		
	4	10	12	11	10	14	11	11	11	12	10	112	10		
	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	6	18	22	19	21	19	20	20	20	21	20	200	10		
	7														
	totals	33	39	34	37	39	36	37	36	38	35	364	10		

Notes: _____

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850		
NEB PROJECT NUMBER: 05.0044476.00	ORGANISM: *Ceriodaphnia dubia*	START DATE:	4/9/19

Effluent Concentration	Day Number	Replicate A	B	C	D	E	F	G	H	I	J	Total Live Young	# Live Adults		
12.5%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	5	5	6	6	6	✓	6	5	6	5	50	10		
	4	13	11	15	16	12	6	12	14	13	13	125	10		
	5	✓	✓	✓	✓	✓	13	✓	✓	✓	✓	13	10		
	6	20	21	23	23	24	19	23	22	25	21	221	10		
	7														
	totals	38	37	44	45	42	38	41	41	44	39	409	10		
		A	B	C	D	E	F	G	H	I	J				
25%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	6	5	3	5	5	✓	6	1	6	5	42	10		
	4	✓	12	8	✓	15	5	12	6	✓	9	67	10		
	5	12	✓	✓	12	✓	12	✓	14	14	✓	64	10		
	6	21	22	23	18	23	13	22	19	19	22	202	10		
	7														
	totals	39	39	34	35	43	30	40	40	39	36	375	10		
		A	B	C	D	E	F	G	H	I	J				
50%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	4	5	6	6	7	✓	6	✓	6	7	47	10		
	4	✓	13	11	14	✓	6	15	5	✓	✓	64	10		
	5	8/x	✓	✓	✓	14	11	✓	10	13	11	67	9		
	6	X	25	18	22	21	18	21	✓	17	17	159	9		
	7														
	totals	12	43	35	42	42	35	42	15	36	35	337	9		
		A	B	C	D	E	F	G	H	I	J				
100%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	4	5	6	6	6	✓	7	5	5	6	50	10		
	4	11	13	12	✓	11	5	✓	✓	13	12	77	10		
	5	✓	✓	✓	14	✓	10	10	12	✓	✓	46	10		
	6	18	19	14	21	18	16	12	18	16	17	169	10		
	7														
	totals	33	37	32	41	35	31	29	35	34	35	342	10		

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID:	06-8232-5132	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:12	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	05-0819-4234	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Apr-19 11:41	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	15 Apr-19 09:50	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	5d 22h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-4650-3640	**Code:**	8BB77D8	**Project:**	
Sample Date:	08 Apr-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Apr-19 15:35	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	1043915	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

2d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**A/B**	**Mean**	**%Effect**
0	D	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

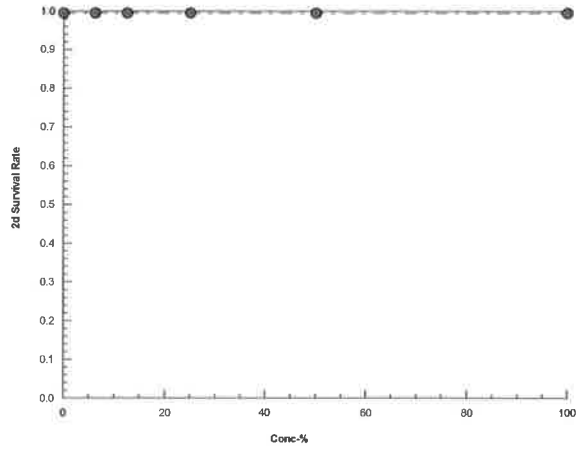
2d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test | **New England Bioassay**

Analysis ID:	06-8232-5132	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:12	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID:	09-1164-7613	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:13	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	05-0819-4234	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Apr-19 11:41	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	15 Apr-19 09:50	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	5d 22h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-4650-3640	**Code:**	8BB77D8	**Project:**	
Sample Date:	08 Apr-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Apr-19 15:35	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	271799	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

6d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**A/B**	**Mean**	**%Effect**
0	D	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.95	5.0%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	0.95	5.0%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

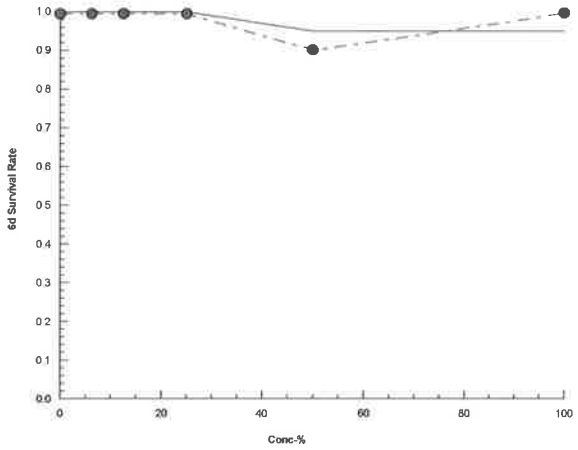
6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test | **New England Bioassay**

Analysis ID:	09-1164-7613	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:13	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	00-1563-7312	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:13	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	05-0819-4234	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Apr-19 11:41	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	15 Apr-19 09:50	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	5d 22h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-4650-3640	**Code:**	8BB77D8	**Project:**	
Sample Date:	08 Apr-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Apr-19 15:35	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	593687	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	36.9	15	>>	Yes	Passes Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

Reproduction Summary

			Calculated Variate						Isotonic Variate	
Conc-%	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**Mean**	**%Effect**
0	D	10	36.9	22	43	6.297	17.07%	0.0%	38.07	0.0%
6.25		10	36.4	33	39	2.011	5.53%	1.36%	38.07	0.0%
12.5		10	40.9	37	45	2.846	6.96%	-10.84%	38.07	0.0%
25		10	37.5	30	43	3.749	10.00%	-1.63%	37.5	1.49%
50		10	33.7	12	43	11.18	33.16%	8.67%	33.95	10.81%
100		10	34.2	29	41	3.327	9.73%	7.32%	33.95	10.81%

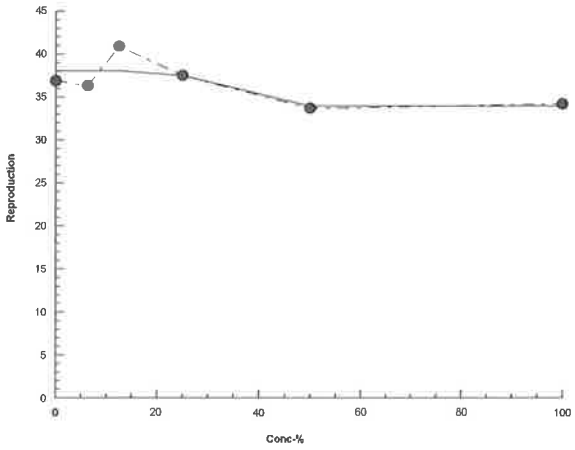
Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	37	22	43	34	43	34	38	36	43	39
6.25		33	39	34	37	39	36	37	36	38	35
12.5		38	37	44	45	42	38	41	41	44	39
25		39	39	34	35	43	30	40	40	39	36
50		12	43	35	42	42	35	42	15	36	35
100		33	37	32	41	35	31	29	35	34	35

Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	00-1563-7312	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:13	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	09-4341-8163	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:13	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1
Batch ID:	05-0819-4234	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Apr-19 11:41	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	15 Apr-19 09:50	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	5d 22h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-4650-3640	**Code:**	8BB77D8	**Project:**	
Sample Date:	08 Apr-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Apr-19 15:35	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	>100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	1.0000	Exact	1.0000	Non-Significant Effect
		12.5	1.0000	Exact	1.0000	Non-Significant Effect
		25	1.0000	Exact	1.0000	Non-Significant Effect
		50	0.5000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	D	10	0	10	1	0	0.0%
6.25		10	0	10	1	0	0.0%
12.5		10	0	10	1	0	0.0%
25		10	0	10	1	0	0.0%
50		9	1	10	0.9	0.1	10.0%
100		10	0	10	1	0	0.0%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

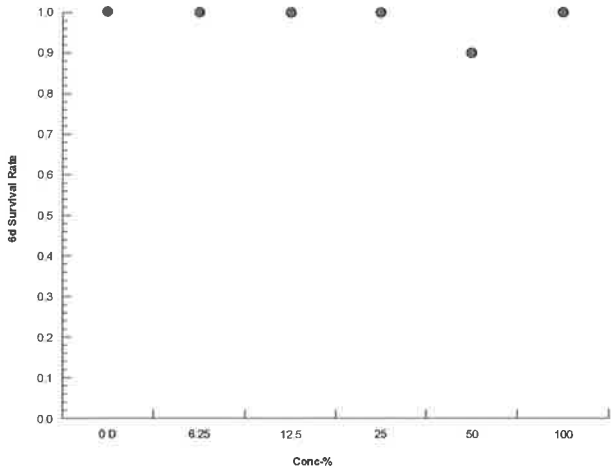
6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test | **New England Bioassay**

Analysis ID:	09-4341-8163	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:13	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	06-1825-2143	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:13	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1
Batch ID:	05-0819-4234	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Apr-19 11:41	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	15 Apr-19 09:50	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	5d 22h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-4650-3640	**Code:**	8BB77D8	**Project:**	
Sample Date:	08 Apr-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Apr-19 15:35	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	>100	n/a	1	16.09%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	95.5	75	5	18	Asymp	0.5455	Non-Significant Effect
		12.5	128	75	3	18	Asymp	0.9989	Non-Significant Effect
		25	106.5	75	4	18	Asymp	0.8650	Non-Significant Effect
		50	97	75	2	18	Asymp	0.5980	Non-Significant Effect
		100	81.5	75	2	18	Asymp	0.1312	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	36.9	15	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	336	67.2	5	1.998	0.0937	Non-Significant Effect
Error	1816.4	33.637	54			
Total	2152.4		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	34.94	15.09	1.6E-06	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.842	0.9459	1.8E-06	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	10	36.9	32.4	41.4	37.5	22	43	1.991	17.07%	0.00%
6.25		10	36.4	34.96	37.84	36.5	33	39	0.636	5.52%	1.36%
12.5		10	40.9	38.86	42.94	41	37	45	0.9	6.96%	-10.84%
25		10	37.5	34.82	40.18	39	30	43	1.186	10.00%	-1.63%
50		10	33.7	25.71	41.69	35.5	12	43	3.534	33.16%	8.67%
100		10	34.2	31.82	36.58	34.5	29	41	1.052	9.73%	7.32%

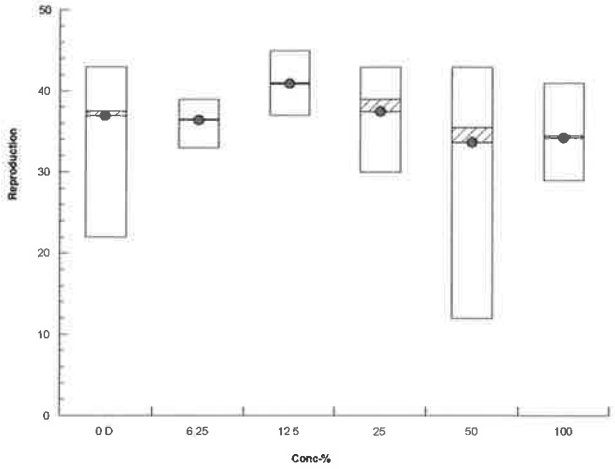
Reproduction Detail

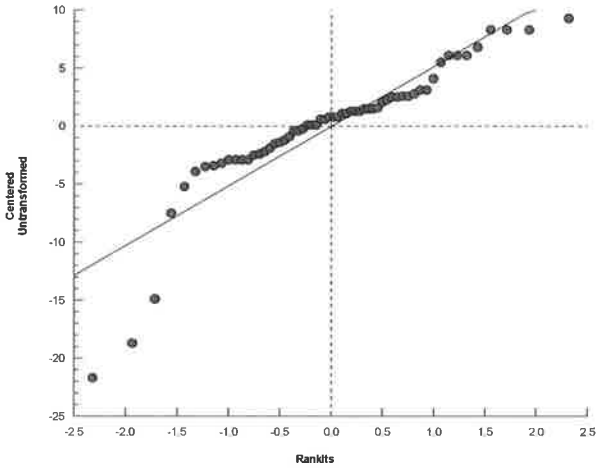
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	37	22	43	34	43	34	38	36	43	39
6.25		33	39	34	37	39	36	37	36	38	35
12.5		38	37	44	45	42	38	41	41	44	39
25		39	39	34	35	43	30	40	40	39	36
50		12	43	35	42	42	35	42	15	36	35
100		33	37	32	41	35	31	29	35	34	35

Ceriodaphnia 7-d Survival and Reproduction Test **New England Bioassay**

Analysis ID:	06-1825-2143	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	16 Apr-19 10:13	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1

Graphics





NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850							
NEB PROJECT NUMBER:	05.0044476.00			TEST ORGANISM		*Ceriodaphnia dubia*		
DILUTION WATER SOURCE:	Laboratory Soft Water			START DATE:		4/9/19	TIME:	1141
ANALYST	CH	MM	MM	PD	PD	CW		
NEB Lab Diluent	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.0	25.2	25.2	25.1	25.5	25.6		
D.O. mg/L Initial	8.1	8.2	8.2	8.3	8.2	8.3		
pH s.u. Initial	7.4	7.7	7.6	7.5	7.9	8.1		
Conductivity µS Initial	185	187	185	186	190	196		
Temp °C Final	24.1	25.0	25.2	24.7	24.6	25.0		
D.O. mg/L Final	8.4	8.3	8.3	8.2	8.3	7.8		
pH s.u. Final	7.9	8.0	8.0	7.9	8.1	7.2		
Conductivity µS Final	194	198	197	194	193	198		
Merrimack River Control	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.0	24.6	25.6	24.6	25.4	25.6		
D.O. mg/L Initial	9.1	9.2	10.3	8.7	9.6	8.8		
pH s.u. Initial	7.5	7.6	7.5	7.5	7.4	7.7		
Conductivity µS Initial	124	125	117	116	120	119		
Temp °C Final	24.2	25.0	25.2	24.8	24.6	25.0		
D.O. mg/L Final	8.2	8.3	8.2	8.2	8.1	7.8		
pH s.u. Final	7.7	7.8	7.8	7.7	8.1	6.9		
Conductivity µS Final	133	134	124	125	124	126		
6.25%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.2	24.7	25.4	25.0	25.5	25.7		
D.O. mg/L Initial	8.4	8.4	8.4	9.1	8.4	8.6		
pH s.u. Initial	7.4	7.5	7.4	7.4	7.8	7.7		
Conductivity µS Initial	248	255	247	241	248	256		
Temp °C Final	24.2	25.0	25.3	24.9	24.5	25.0		
D.O. mg/L Final	8.2	8.3	8.2	8.2	8.0	7.8		
pH s.u. Final	7.7	7.7	7.8	7.9	7.9	7.3		
Conductivity µS Final	258	262	253	250	258	266		
12.5%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.2	25.2	25.8	25.3	25.6	25.8		
D.O. mg/L Initial	8.2	8.2	8.3	8.3	8.3	8.3		
pH s.u. Initial	7.5	7.6	7.6	7.6	7.8	7.7		
Conductivity µS Initial	311	314	321	313	323	332		
Temp °C Final	24.2	25.0	25.3	24.9	24.5	25.1		
D.O. mg/L Final	8.2	8.2	8.3	8.2	8.1	7.9		
pH s.u. Final	7.8	7.8	7.8	7.9	7.9	7.5		
Conductivity µS Final	322	331	326	321	332	341		

NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850							
NEB PROJECT NUMBER:	05.0044476.00			TEST ORGANISM		*Ceriodaphnia dubia*		
DILUTION WATER SOURCE:	Laboratory Soft Water			START DATE:		4/9/19	TIME:	1141
25%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.1	25.3	25.8	25.3	25.6	25.8		
D.O. mg/L Initial	8.3	8.1	8.3	8.3	8.4	8.2		
pH s.u. Initial	7.5	7.6	7.6	7.6	7.7	7.7		
Conductivity µS Initial	440	450	453	460	471	478		
Temp °C Final	24.3	24.9	25.2	24.8	24.6	25.1		
D.O. mg/L Final	8.2	8.2	8.3	8.2	8.0	7.9		
pH s.u. Final	7.9	7.9	7.9	8.0	7.9	7.7		
Conductivity µS Final	450	470	456	468	478	489		
50%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.1	25.1	25.8	25.3	25.5	25.9		
D.O. mg/L Initial	8.4	8.2	8.7	8.3	8.8	8.4		
pH s.u. Initial	7.5	7.5	7.5	7.5	7.6	7.6		
Conductivity µS Initial	681	688	727	729	765	759		
Temp °C Final	24.3	24.9	25.3	24.8	24.4	25.1		
D.O. mg/L Final	8.2	8.2	8.3	8.2	8.0	7.8		
pH s.u. Final	8.1	7.9	8.1	8.1	8.0	7.8		
Conductivity µS Final	687	718	728	738	769	770		
100%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.0	24.6	25.7	25.2	25.1	25.9		
D.O. mg/L Initial	9.0	8.5	9.4	8.3	9.5	8.6		
pH s.u. Initial	7.4	7.4	7.4	7.5	7.5	7.5		
Conductivity µS Initial	1,204	1,210	1,277	1,273	1,331	1,329		
Temp °C Final	24.2	24.7	25.4	24.8	24.6	25.0		
D.O. mg/L Final	8.2	8.2	8.1	8.1	8.0	7.7		
pH s.u. Final	8.2	8.1	8.2	8.2	8.2	8.0		
Conductivity µS Final	1,207	1,227	1,268	1,274	1,327	1,324		

Table of Random Permutations of 16

C.dubia Test ID# 19-449

7	12	15	15	1	2	7	16	10	2	14	15	7	13	13	10	6	1	8	10
13	3	8	16	7	10	11	10	13	5	11	7	13	16	7	7	5	13	2	14
3	1	4	5	14	13	3	14	9	13	13	2	9	15	6	2	8	4	5	8
11	8	16	14	15	6	2	6	2	16	8	5	12	3	9	13	4	3	10	4
14	9	1	6	3	9	14	13	8	6	5	8	14	7	3	15	13	11	4	7
2	16	10	13	5	5	13	2	11	7	3	12	5	14	12	16	2	2	9	15
4	6	13	7	2	15	1	9	1	4	7	10	6	9	11	9	7	6	16	11
6	14	6	10	4	14	4	15	3	3	4	16	2	6	5	1	12	10	6	9
10	15	2	1	13	12	16	3	4	8	10	1	15	5	14	12	14	12	3	2
12	10	7	12	9	11	9	8	12	14	15	4	11	8	16	8	9	14	14	1
15	7	5	2	10	7	8	12	6	15	6	13	16	12	15	4	11	8	12	6
16	2	11	8	8	8	15	5	16	1	1	9	8	1	8	14	16	5	13	5
9	13	14	3	6	4	10	11	5	12	9	3	10	4	4	3	10	9	1	3
8	11	9	4	11	3	12	7	7	10	12	14	3	10	1	6	15	16	15	12
1	5	12	11	16	16	5	4	14	9	16	11	1	2	10	5	1	15	7	13
5	4	3	9	12	1	6	1	15	11	2	6	4	11	2	11	3	7	11	16
11	8	16	5	5	13	1	13	2	16	14	12	9	8	7	5	13	3	13	3
2	2	8	8	14	16	4	3	8	11	10	14	15	1	2	11	4	5	15	9
6	13	2	13	6	5	9	15	11	10	12	6	16	15	16	9	10	12	16	15
14	12	4	16	16	11	14	10	5	12	3	3	12	14	15	13	6	4	1	16
8	6	3	9	4	10	6	4	16	2	2	9	8	16	4	6	5	15	7	8
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3	10	11	12	13	12	5	11	7	8	9	5	14	11	10	1	3	13	3	5
16	1	13	14	8	14	15	5	3	7	11	15	6	12	5	7	11	1	14	4
1	14	14	2	9	15	16	14	6	14	7	8	3	13	11	8	7	7	12	7
4	4	6	4	12	3	11	8	15	9	8	1	13	6	3	3	15	9	9	12
15	5	1	11	10	6	3	7	10	5	5	11	10	10	12	15	16	14	5	2
5	3	5	6	7	7	13	2	14	3	16	4	5	5	13	4	9	16	2	6
12	7	15	15	15	9	8	12	12	13	15	10	1	4	6	16	2	6	11	1
10	11	10	3	2	4	2	1	4	6	6	7	11	9	14	10	8	11	4	13
7	9	7	7	11	1	7	16	13	1	13	2	4	2	1	2	12	2	10	14
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12	5	10	7	2	14	7	15	14	16	13	1	9	10	12	10	11	10	9	8
8	9	8	10	6	4	11	7	10	11	6	8	4	9	8	15	8	6	11	9
2	7	6	2	1	8	10	6	15	12	1	11	7	11	13	6	1	15	13	15
6	4	15	8	16	10	14	16	9	6	12	3	10	6	14	7	2	12	16	7
5	8	12	15	7	3	12	5	12	9	5	15	1	13	15	13	15	5	1	2
										con							rep		
13	4	10	4	16	13	16	13	5	3	6	14	1	16	8	7	2	3	3	12
5	14	4	6	8	2	15	1	13	14	16	4	15	4	3	12	12	1	4	7
2	2	2	15	14	16	9	12	16	6	10	15	14	9	10	1	14	8	8	16
7	12	15	8	12	3	5	14	7	12	5	13	16	1	7	5	11	2	9	3
6	9	7	14	9	14	10	11	15	11	12	1	12	12	14	16	3	11	11	8
14	5	16	7	10	8	11	8	14	13	7	11	6	3	11	4	4	6	6	9
15	11	8	9	7	12	8	7	1	15	9	3	3	7	13	11	10	4	5	1
11	6	6	1	4	1	3	16	12	5	4	9	13	13	6	8	15	9	1	14
4	10	3	16	2	11	7	9	6	9	1	8	4	11	5	2	16	10	12	4
1	8	1	13	1	15	4	4	11	4	2	16	5	8	1	9	5	12	16	6
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8	13	13	3	3	10	13	2	4	1	8	6	11	14	15	6	9	16	2	2
16	16	5	12	11	6	1	3	8	16	3	7	2	5	16	14	13	7	14	15

Ceriodaphnia dubia Culture Chart

Lot # Cd19 (RMH 0616) B

Brood mother source: RMH 0100 B13 Source's brood size: 25 (Qty.)

Lowell 4-9-19

Tech	KF	AH	KF	KF	AH		MC	AH		AH						
Date	4.1	4.2	4.3	4.4	4.5		4.7	4.8		4.9						
Day acc.	0	1	2	3	4	5	6	7		8	9	10	11	12	13	14
Cup # 1	N	N	N	N	4		Y2B	N	1	Y						
2	N	N	N	N	5		9 Y2B	N	2	T1 Y17						
3	N	N	N	N	4		8 Y2B	N	3	T2 Y20						
4	N	N	N	N	5		13 Y2B	N	4	T3 Y19						
5	N	N	N	N	4		12	Y	5	T4 Y17						
6	N	N	N	N	4		12 Y2B	N	6	T5 Y21						
7	N	N	N	N	5		Y2B	N	7	Y						
8	N	N	N	N	6		Y2B	N	8	T6 Y20						
9	N	N	N	N	4		Y2B	N	9	Y						
10	N	N	N	N	5		Y2B	N	10	Y						
11	N	N	N	N	5		13 Y2B	N	11	T7 Y19						
12	N	N	N	N	5		12	Y	12	T8 Y17						
13	N	N	N	N	4		15 Y2B	N	13	99 Y21						

Y = neonates present, and *criterion has been met:* ≥ 20 neonates produced in total by 3rd brood. **N** = no neonates

2B = two broods present. **2Y** = two broods and criterion met: ≥ 20 neos. by 3rd brood. **X** = brood mother dead **ae** = aborted eggs

✓ or **P** = neonates present after renewal on previous day (see time in log). **A→** = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted). **acc.** = *if acclimated*, H_2O type used w/ renewal **this** day.

Test organism collection:

Project #	Symbols (✓ / P)	Tray diagram used? (Y/N)	Time period, neonates released	Collection date / time
00444476	(T)	Y	4-8-19/1600 → 4-8-19/1900	4-9-19/1040
	T			
	T			
	T			
	T			
	T			

4.7-19 2nd brood released before renewal @ 1000 ml

Ceriodaphnia dubia Culture Chart

Lot # cd19(RMH 0626) A

Brood mother source: RMH 0626 B4 Source's brood size: 24 (Qty.)

Lowell 4.9.19

Tech	KF	AH	KF	KF	AH		MC	AH		AH						
Date	4.1	4.2	4.3	4.4	4.5		4.7	4.8		4.9						
Day acc.	0	1	2	3	4	5	6	7		8	9	10	11	12	13	14
Cup # 1	N	N	N	N	4		~~10~~ 12B	N	1	T1 Y17						
2	N	N	N	N	4		4 12B	N	2	4						
3	N	N	N	N	6		~~10~~ 12B	N	3	T2 Y20						
4	N	N	N	N	5		4 12B	N	4	T3 Y23						
5	N	N	N	N	4		H 12B	N	5	T4 Y24						
6	N	N	N	N	5		9	Y	6	T5 Y21						
7	N	N	N	N	4		Y 12B	N	7	T6 Y20						
8	N	N	N	N	5		~~10~~ 12B	N	8	T7 Y23						
9	N	N	N	N	6		Y 12B	N	9	T8 Y19						
10	N	N	N	N	5		~~10~~ 12B	N	10	T9 Y21						
11	N	N	N	N	4		H 12B	N	11	T10 Y22						
12	N	N	N	N	5		12	Y	12	T10 Y 19						
13	N	N	N	N	5		10	Y	13	Y						

Y = neonates present, and *criterion has been met:* ≥ 20 neonates produced in total by 3rd brood. **N** = no neonates

2B = two broods present. **2Y** = two broods and criterion met: ≥ 20 neos. by 3rd brood. **X** = brood mother dead **ae** = aborted eggs

✓ or **P** = neonates present after renewal on previous day (see time in log). **A→** = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted). **acc.** = *if acclimated*, H_2O type used w/ renewal **this** day.

Test organism collection:

Project #	Symbols (✓ / P)	Tray diagram used? (Y/N)	Time period, neonates released	Collection date / time
0044087	T	Y	4-8-19/1440 → 4-8-19/1900	4-9-19/1015
0044476	T	Y	4-8-19/1600 → 4-8-19/1900	4-9-19/1040
	T			
	T			
	T			
	T			

4-7-19 2nd brood released before renewal @ 1000 me

SAMPLE RECEIPT CHEMISTRY
&
CHAIN OF CUSTODY DOCUMENTS

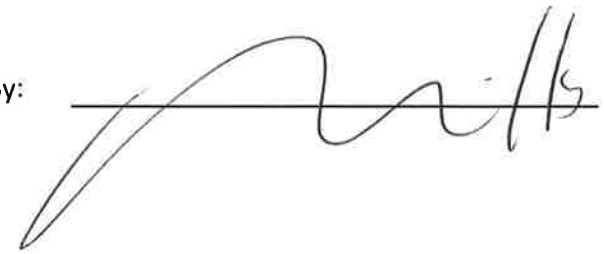
NEW ENGLAND BIOASSAY - INITIAL CHEMISTRY DATA

PERMITTEE: Lowell RWWU

NEB JOB # 05.0044476.00

DATE RECEIVED	4/8/19		4/11/19		4/12/19	
SAMPLE TYPE:	EFF #1	RIVER #1	EFF #2	RIVER #2	EFF #3	RIVER #3
COC #	C39-1787	C39-1788	C39-1835	C39-1836	C39-1875	C39-1876
pH (SU)	7.1	6.9	7.2	7.4	7.1	7.1
Temperature (^{o}C)	7.7	8.6	8.2	6.1	4.5	4.6
Dissolved Oxygen (mg/L)	8.5	9.2	10.5	11.0	11.5	12.5
Conductivity (µmhos)	1,232	125	1,297	116	1,365	119
Salinity (ppt)	< 1	< 1	<1	<1	<1	<1
TRC - DPD (mg/L)	0.013	0.004	0.011	0.005	0.027	0.009
TRC - Amperometric (mg/L)	NA	NA	NA	NA	NA	NA
Hardness (mg/L as $CaCO_3$)	90	14	110	14	104	14
Alkalinity (mg/l as $CaCO_3$)	100	10	110	10	120	10
Tech Initials	CW	CW	PD	PD	KO	KO

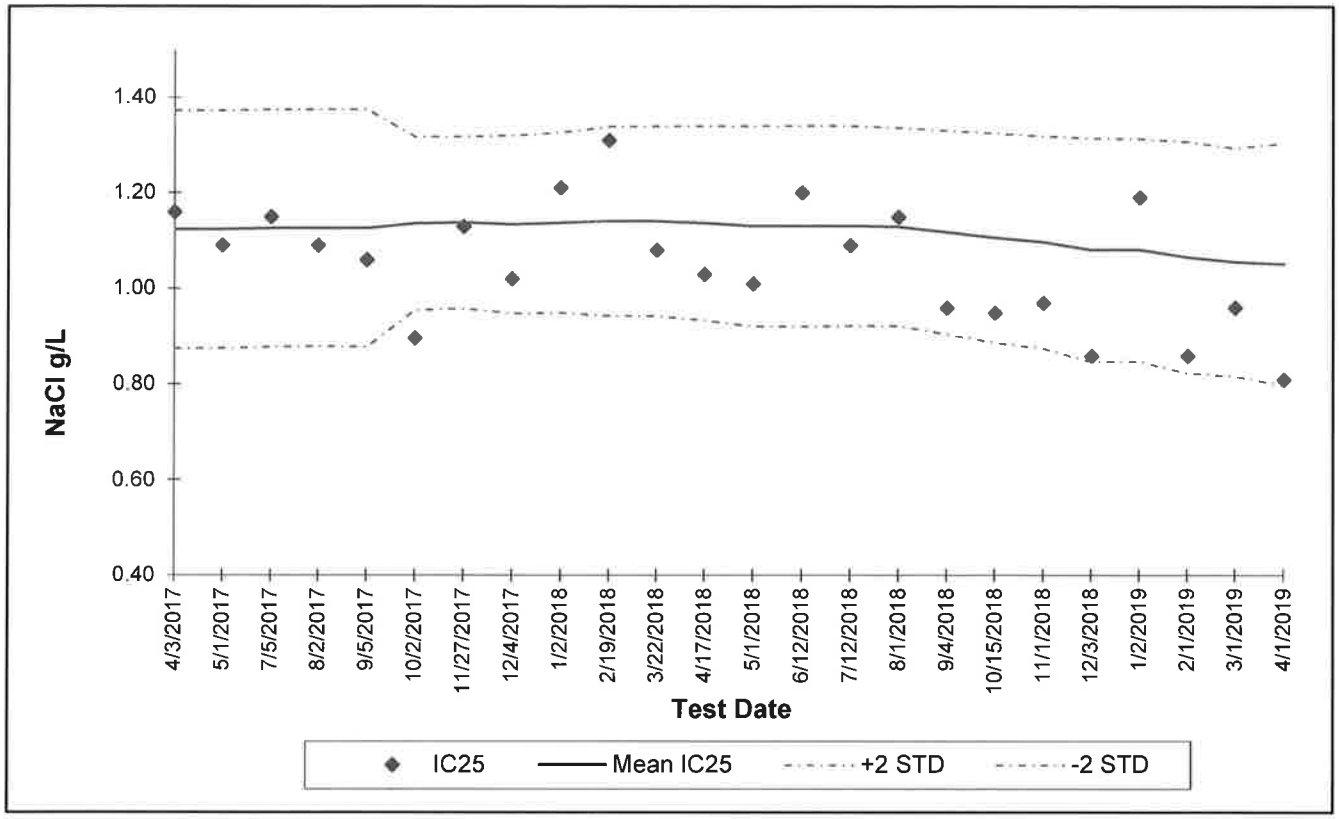
NOTE: NA = NOT APPLICABLE

Data Reviewed By:  Date Reviewed: 5/6/19

REFERENCE TOXICANT CHARTS

New England Bioassay

Reference Toxicant Data: Sodium chloride (NaCl) *Ceriodaphia dubia* Chronic Reproduction IC_{25}



Test ID	Date	IC_{25}	Mean IC_{25}	STD	-2STD	+2STD	Avg. CV	Repro PMSD (%)	Avg. PMSD (%)
17-480	4/3/2017	1.16	1.12	0.12	0.87	1.37	0.11	13.66	15.27
17-616	5/1/2017	1.09	1.12	0.12	0.88	1.37	0.11	8.00	14.84
17-972	7/5/2017	1.15	1.13	0.12	0.88	1.37	0.11	12.67	14.72
17-1146	8/2/2017	1.09	1.13	0.12	0.88	1.38	0.11	23.94	15.20
17-1317	9/5/2017	1.06	1.13	0.12	0.88	1.38	0.11	33.78	16.13
17-1516	10/2/2017	0.90	1.14	0.09	0.95	1.32	0.08	24.47	16.53
17-1787	11/27/2017	1.13	1.14	0.09	0.96	1.32	0.08	19.97	16.69
17-1846	12/4/2017	1.02	1.13	0.09	0.95	1.32	0.08	14.69	16.60
18-10	1/2/2018	1.21	1.14	0.09	0.95	1.33	0.08	10.81	16.36
18-271	2/19/2018	1.31	1.14	0.10	0.94	1.34	0.09	22.90	16.56
18-416	3/22/2018	1.08	1.14	0.10	0.94	1.34	0.09	17.59	16.88
18-553	4/17/2018	1.03	1.14	0.10	0.93	1.34	0.09	38.54	17.77
18-607	5/1/2018	1.01	1.13	0.10	0.92	1.34	0.09	24.65	18.25
18-816	6/12/2018	1.20	1.13	0.11	0.92	1.34	0.09	46.97	19.59
18-996	7/12/2018	1.09	1.13	0.10	0.92	1.34	0.09	11.41	19.70
18-1103	8/1/2018	1.15	1.13	0.10	0.92	1.34	0.09	17.23	19.67
18-1315	9/4/2018	0.96	1.12	0.11	0.91	1.33	0.10	22.12	20.09
18-1577	10/15/2018	0.95	1.11	0.11	0.89	1.33	0.10	24.32	20.64
18-1625	11/1/2018	0.97	1.10	0.11	0.88	1.32	0.10	31.57	21.34
18-1756	12/3/2018	0.86	1.08	0.12	0.85	1.32	0.11	15.77	21.00
19-8	1/2/2019	1.19	1.08	0.12	0.85	1.31	0.11	40.72	21.30
19-177	2/1/2019	0.86	1.07	0.12	0.82	1.31	0.11	18.71	21.63
19-265	3/1/2019	0.96	1.06	0.12	0.82	1.29	0.11	19.84	22.13
19-403	4/1/2019	0.81	1.05	0.13	0.80	1.30	0.12	10.09	21.85

National 75th Percentile and 90th Percentile CV Averages for Ceriodaphnia Reproduction IC25 (EPA 833-R-00-003): 0.45 - 0.62
PMSD Upper and Lower Bounds for Ceriodaphnia Reproduction (EPA-821-R-02-013): 13% - 47%

Results:

Sample: Effluent
9D08025-01 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**110**	4	mg/L	04/10/19
Ammonia	**16.3**	0.5	mg/L	04/11/19
pH	**7.3**	0.1	SU	04/08/19 16:40
Specific Conductance	**1160**	2	uS/cm	04/09/19
Total Dissolved Solids	**508**	10	mg/L	04/09/19
Total Organic Carbon	**7.8**	1.0	mg/L	04/09/19
Total solids (TS)	**580**	10	mg/L	04/09/19
Total Suspended Solids	**6**	2	mg/L	04/09/19

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**28.9**	0.01	mg/L	04/10/19
Magnesium	**5.10**	0.01	mg/L	04/10/19
Cadmium	ND	0.0001	mg/L	04/11/19
Lead	**0.0007**	0.0002	mg/L	04/15/19
Aluminum	**0.031**	0.012	mg/L	04/10/19
Copper	**0.008**	0.005	mg/L	04/10/19
Nickel	**0.005**	0.001	mg/L	04/10/19
Zinc	**0.073**	0.005	mg/L	04/10/19
Total Hardness	**93.2**	0.0312	mg/L	04/10/19

Sample: Merrimack River
9D08025-02 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**7**	2	mg/L	04/10/19
Ammonia	**0.1**	0.1	mg/L	04/11/19
pH	**7.0**	0.1	SU	04/08/19 16:40
Specific Conductance	**115**	2	uS/cm	04/09/19
Total Dissolved Solids	**16**	10	mg/L	04/24/19
Total Organic Carbon	**2.4**	1.0	mg/L	04/09/19
Total solids (TS)	**72**	10	mg/L	04/09/19
Total Suspended Solids	ND	2	mg/L	04/09/19

Sample: Merrimack River (Continued)
9D08025-02 (Water)

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**4.33**	0.01	mg/L	04/10/19
Magnesium	**0.88**	0.01	mg/L	04/10/19
Cadmium	ND	0.0001	mg/L	04/11/19
Lead	**0.0008**	0.0002	mg/L	04/15/19
Aluminum	**0.141**	0.012	mg/L	04/10/19
Copper	ND	0.005	mg/L	04/10/19
Nickel	ND	0.001	mg/L	04/10/19
Zinc	**0.011**	0.005	mg/L	04/10/19
Total Hardness	**14.4**	0.0312	mg/L	04/10/19

Sample Set #1

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: JIN BOK McGOVAN

Title: CHEMIST

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X **Composite**

Sample ID:

Start Date: 4-7-19 Time: 7:00

End Date: 4-8-19 Time: 7:00

RECEIVING WATER

Sampler: Aaron Fox

Title: Ops Supervisor

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab

Sample ID: Merrimack River

Date Collected: 4-8-19

Time Collected: 8:30 AM

Sampling Method: _____ **Grab** (for pH and TRC only_____)

Date Collected:

Time Collected:

Sample Type:

_____ Prechlorinated
X Dechlorinated
_____ Unchlorinated
_____ Chlorinated

Received
ON ICE

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By:		Date: 4-8-19	Time: 10:35
Received By:	BPacheco	Date: 4-8-19	Time: 10:35
Relinquished By:	BPacheco	Date: 4-8-19	Time: 1445
Received By:	CRun	Date: 4-8-19	Time: 1445
Relinquished By:	CRun	Date: 4-15-19	Time: 1535
Received By:		Date: 4/8/19	Time: 1535

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 7.7 °C

Temperature of Receiving Water Upon Receipt at Lab: 8.6 °C

Effluent COC# C39-1787

Receiving Water COC# C39-1788

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

Sample Set #2

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: JIN-BOK MCGOWAN

Title: CHEMIST

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X **Composite**

Sample ID: pH. EFF

Start Date: 4-9-2019 Time: 7:00

End Date: 4-10-2019 Time: 7:00

Sampling Method: _____ **Grab** (for pH and TRC only_____)

Date Collected: _____

Time Collected: _____

Sample Type:

_____ Prechlorinated
X Dechlorinated
_____ Unchlorinated
_____ Chlorinated

RECEIVING WATER

Sampler: Aaron Fox

Title: Ops Superintendent

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab

Sample ID: Merrimack River

Date Collected: 4-10-2019

Time Collected: 8:20 AM

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Received ON ICE

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By:	Date: 4-10-19	Time: 11:10 A
Received By:	Date: 4/10/19	Time: 11:10 A
Relinquished By:	Date: 4/10/19	Time: 1500
Received By:	Date: 4-10-19	Time: 1500
Relinquished By:	Date: 4-10-19	Time: 1545
Received By:	Date: 4/10/19	Time: 1545

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 8.2 °C

Temperature of Receiving Water Upon Receipt at Lab: 6.1 °C

Effluent COC# C39-1835

Receiving Water COC# C39-1836

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

Sample Set #3

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: JIN-BOK MCGOWN

Title: CHEMIST

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X **Composite**

Sample ID:

Start Date: 4-11-2019 Time: 7:00

End Date: 4-12-2019 Time: 7:00

RECEIVING WATER

Sampler: Aaron Fox

Title: O/S Supervisor

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab

Sample ID: Merrimack River

Date Collected: 4-12-19

Time Collected: 8:50

Sampling Method: _____ **Grab** (for pH and TRC only_____)

Date Collected:

Time Collected:

Sample Type:

_____ Prechlorinated
X Dechlorinated
_____ Unchlorinated
_____ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Received
ON ICE

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By:	Date: 4-12-19	Time: 12:00
Received By:	Date: 4-12-19	Time: 12:00
Relinquished By:	Date: 4/12/19	Time: 1420
Received By:	Date: 4/12/19	Time: 1420
Relinquished By:	Date: 4/12/19	Time: 1575
Received By:	Date: 4/12/19	Time: 1520

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 4.5 °C

Temperature of Receiving Water Upon Receipt at Lab: 4.9 °C

Effluent COC# C39-1875

Receiving Water COC# C39-1876

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042